

# Mark-Recapture Research on King Mackerel, *Scomberomorus cavalla*, in the Gulf of Mexico

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## Abstract

Over 6,900 king mackerel were tagged with internal anchor tags between 1983 and 1989 from northwest Florida westward and southward through the Gulf of Mexico to waters off the Yucatan Peninsula of Mexico. Three hundred and ninety-two tags were recovered. Previous studies indicated that king mackerel from south Florida waters moved into and across the northern Gulf in spring and summer, and returned in the fall to wintering grounds in south Florida. Other studies presented evidence for two or more migratory groups of king mackerel in the Gulf of Mexico. The present report provides convincing evidence for a migratory group in the western Gulf which seasonally moves between U.S. waters in the north and Mexican waters in south, and is exploited in both countries.

## Introduction

The king mackerel, *Scomberomorus cavalla*, is a coastal pelagic scombrid that ranges from Cape Cod to Brazil in the western Atlantic Ocean. In the Gulf of Mexico, this species supports important commercial and recreational fisheries in the United States as well as commercial fisheries in Mexican coastal waters. In U.S. waters, king mackerel are regulated by fishery management plans which impose catch quotas and daily bag limits. No regulations exist in Mexican waters.

Results of previous mark-recapture studies on king mackerel in the Gulf have been published by several authors. Williams and Godcharles (1984) discussed movements of fish tagged in the Gulf off southwest Florida, Texas and Veracruz, Mexico between 1976 and 1979. Vasconcelos (1987) reported on king and Spanish mackerel migrations along the Mexican Gulf coast. Work by Sutter et al. (1991) was a more recent analysis of the tagging study conducted in the 1970s by Williams and Godcharles.

Results from these mark-recapture studies show a generalized pattern of king mackerel movements in the Gulf. In spring, fish migrate northward from wintering grounds off south and southwest Florida (Figure 1). By late summer they occur throughout the northern Gulf (Figure 2).

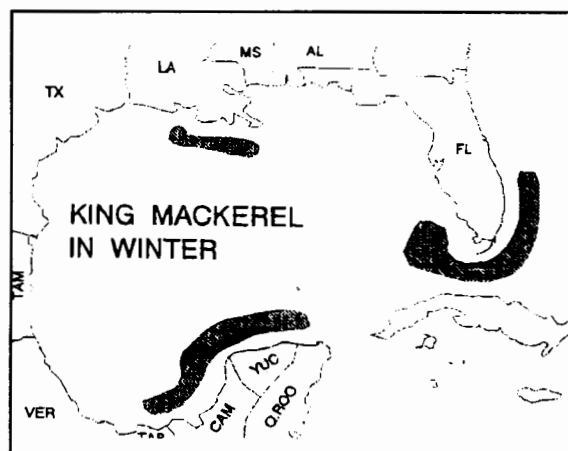


Figure 1. Winter distribution of king mackerel.

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As winter approaches, these fish again return to southern Florida; but there are indications that some winter off Mexico. Data also indicate that many larger king mackerel reside year round in the northwestern Gulf.

## Methods

As part of MEXUS-Gulf cooperative research, king mackerel were tagged in U.S. waters off northwest Florida, southeast Louisiana, and Texas and in Mexican waters off Tamaulipas, Veracruz, and the Yucatan Peninsula (Figure 3). Over the years, numerous organizations participated in the tagging effort. They include the National Marine Fisheries Service, the Instituto Nacional de la

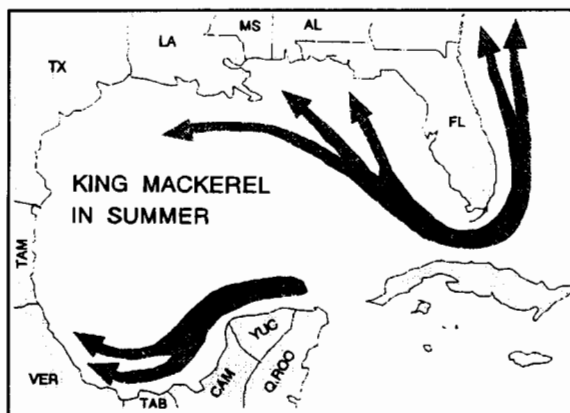


Figure 2. Summer distribution of king mackerel.

Pesca, Mote Marine Laboratory, the Texas Parks and Wildlife Department (TPWD), Louisiana State University (LSU), and the Louisiana Department of Wildlife and Fisheries (LDWF).

Briefly, we used internal anchor tags which had a retainer 32 mm long and 8 mm wide, and a streamer 89 mm long. All tags were either bright red or international orange and had an identification number and return address printed on them. Rewards of \$10 per tag return were offered and in recent years, to combat poor returns rates in the U.S., a yearly \$1,000 drawing was initiated for U.S. returned tags. In all areas, posters and other means of informing the public (especially newspaper and magazine articles) were used to advertise the tagging program and the rewards.

King mackerel to be tagged were taken by the most effective method available in each tagging area. Usually, this involved catching the fish by hook and line, either off private or government-owned boats, or off commercial

handline vessels. However, off Veracruz, many king mackerel were taken using commercial trap nets (almadrabas); this method was quite productive when these nets were available. After the king mackerel were unhooked or removed from the trap net, they were placed belly-up in a V-shaped tagging cradle and their fork lengths were measured. A small slit (8-10 mm long) was made in the abdomen with a scalpel and the disk portion of the internal anchor tag was inserted. The fish was then released into the water.

From January 1983 through December 1989, 6,910 king mackerel were tagged in the Gulf (Table 1). Fish were tagged during every month of the year with the greatest numbers tagged in May (over 1,400) off Veracruz and in December (over 1,100) off Louisiana. Three-hundred ninety-two tags were recovered: 158 from fish tagged off the states of Tamaulipas and Veracruz, 4 from fish tagged off the Yucatan Peninsula, 111 from fish tagged off north-west Florida, 76 from fish tagged off Louisiana, and 43 from fish tagged off Texas. The overall return rate was 5.7%.

### Northwest Florida Results

Sixteen hundred and fifty-six king mackerel were tagged off Panama City, northwest Florida, by the NMFS during the months of May through October from 1983 through 1988. We used small government outboard boats and the fishing was relatively close to shore. In general, these fish were smaller than any others tagged in the northern Gulf. There were 111 recovered tags, (a return rate of 6.7%).

Fish tagged off northwest Florida were recaptured dur-

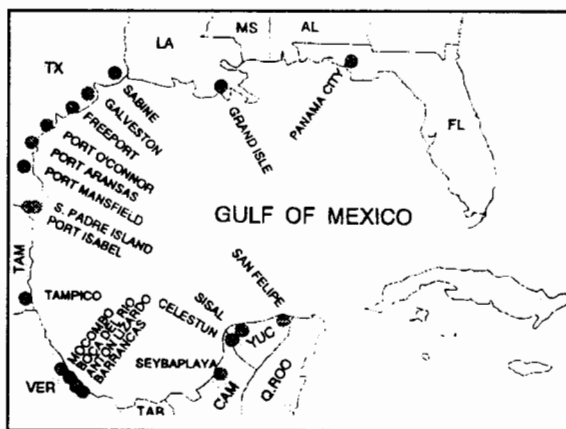


Figure 3. Tagging locations in the Gulf of Mexico.

Table 1. King mackerel tag recoveries by area and year.

Year		Northwest Florida	Louisiana	Texas	Tamaulipas/ Veracruz	Yucatan Peninsula	Combined
1983	Tagged	69	1,409	0	0	0	1,478
	Recovered	10 (14%)	40 (3%)	0	0	0	50 (3%)
1984	Tagged	147	44	0	18	0	209
	Recovered	8 (5%)	5 (11%)	0	0 (0%)	0	13 (6%)
1985	Tagged	6	515	100	369	0	990
	Recovered	1 (17%)	24 (5%)	3 (3%)	11 (3%)	0	39 (4%)
1986	Tagged	556	0	63	175	118	912
	Recovered	21 (4%)	0	6 (10%)	7 (4%)	2 (2%)	36 (4%)
1987	Tagged	402	430	178	461	13	1,484
	Recovered	21 (5%)	7 (2%)	12 (7%)	28 (6%)	0 (0%)	68 (5%)
1988	Tagged	476	0	253	524	17	1,270
	Recovered	50 (11%)	0	20 (8%)	75 (14%)	2 (12%)	147 (12%)
1989	Tagged	0	0	21	530	16	567
	Recovered	0	0	2 (10%)	37 (7%)	0 (0%)	39 (7%)
Total	Tagged	1,656	2,398	615	2,077	164	6,910
	Recovered	111 (7%)	76 (3%)	43 (7%)	158 (8%)	4 (2%)	392 (6%)

ing every month of the year except November. Most (57, or 51%) were recovered in the summer months from the northern Gulf between Sarasota, Florida and Port Aransas, Texas, but one was returned from Veracruz, Mexico. During the winter months, 19 tags were recovered (17% of the total); all but two were from south, southwest or southeast Florida. Of the two others, one was recaptured off Campeche, Mexico, while the other was recaptured off Grand Isle, Louisiana. Recoveries of 35 tags (32% of the total) in spring and fall were spread between the northern Gulf and south and southeast Florida.

Sutherland and Fable (1980) deduced from tagging off northwest Florida that an annual migration occurred from south Florida to the northern Gulf of Mexico in the spring and that these fish returned to south Florida in the fall. We had no direct evidence that king mackerel tagged off northwest Florida ever moved farther west. We now know of 16 tag recoveries reported from the northern Gulf, west of the state of Florida. Also two tag recoveries from

Mexico, one from Veracruz and one from Campeche, were reported.

Most northwest Florida fish appear to winter off south Florida, but as they get older and larger, they migrate farther west in the northern Gulf in their summer grounds. Some of these fish may recruit to a year-round resident stock off Louisiana, as evidenced by one winter tag return off Louisiana. A small percentage of the fish tagged in northwest Florida may actually belong to a western Gulf group of king mackerel and be near the eastern edge of their range at the time of tagging, as evidenced by two tag recoveries from Mexico.

#### Louisiana

When a commercial handline fishery for king mackerel developed in the early 1980s off Grand Isle, Louisiana, we saw an opportunity to acquire king mackerel for tagging in that area. We fished off small commercial trolling boats and small government boats and NMFS biologists

worked with scientists from Louisiana State University and the Louisiana Department of Wildlife and Fisheries.

Off Grand Isle, Louisiana, we tagged 2,398 fish and 76 tags were recovered (a 3.2% return rate). Fish tagged during winter (November through April) (1,853) were generally large with fork lengths (FL) averaging 967 mm, while fish tagged during summer (May through October) (545) had a mean FL of only 805. The tagged king mackerel from Louisiana were recaptured during every month of the year, and were taken in the tagging area during every season. Twenty-six recoveries (34%) were made in winter months with 16 tags returned from Louisiana, 8 from south Florida, 1 from Veracruz and 1 from Campeche. Twenty-nine recoveries (38%) were made during the summer, with all recaptures coming from Texas and Louisiana waters. The 12 fall recoveries and 7 of the 9 spring recoveries also all came from off Texas and Louisiana. Two remaining spring recaptures were from Veracruz.

King mackerel tagged in winter exhibited different movement patterns from those tagged in summer. Winter fish tended to move less distance than summer fish. If winter tagged fish showed any movement at all, it was to the west. Summer tagged fish moved in both directions, with 8 (42%) moving east, 4 (21%) moving west, and 7 (37%) showing no movement.

In 1987 we concluded that there is a year-round resident population of large king mackerel in the northwest Gulf (Fable et al., 1987). The 21 new tag recoveries reported from MEXUS-Gulf tagging support that conclusion. However, two additional tag recoveries from the state of Veracruz from fish tagged in September and November off Louisiana, indicate that migrations to Mexican waters may be more commonplace than previously thought.

### **Texas**

In Texas, 43 tags were recovered from 615 tagged king mackerel (7.0% recovery rate). All fish were tagged from May through September by TPWD biologists and sportsmen. Length-frequency distributions of all tagged fish off Texas indicate a wide range of sizes tagged each year.

The only recoveries in Texas waters occurred in summer. Three other recoveries were made in the summer, one off western Louisiana, and two off Mexico. In the winter months, the only recoveries from fish tagged off Texas were in Mexican waters (Veracruz, Campeche, and Yucatan) and in southern Florida. Four recoveries in Mexico (three in Veracruz, one in Campeche) and one in northwest Florida occurred during spring. During the fall,

three tags were recovered in Mexico, six in the northern Gulf, and one in south Florida.

King mackerel tagging in the 1970s verified that migrations between south Florida in winter and the Texas coast in summer were common. More recent tagging indicates that migrations to Mexican waters may be even more common (15 recoveries in Mexico versus 11 in Florida). This is consistent with electrophoretic evidence found by Dr. Allyn Johnson in which the Texas coast is shown to be a mixing area between fish from both the eastern and western Gulf. Although no winter tag returns came from Louisiana, we believe that some Texas fish also enter the group of year-round residents off Louisiana.

### **Tamaulipas and Veracruz**

In Mexico, the cooperative efforts of the Instituto Nacional de la Pesca (INP), Mote Marine Laboratory and the NMFS enabled us to tag 2,077 king mackerel in the states of Tamaulipas and Veracruz. Were it not for the publicity and development of an effective reward system, the 158 recovered tags would never have materialized.

An intense commercial fishery in the spring off Veracruz provided an excellent means of acquiring fish for tagging. The almadrabas which were used for several seasons enabled us to simply pick fish out of the net while it was being tended and tag them. The other method used in this area was to troll from INP skiffs or go out with the handline fishermen to acquire fish for tagging.

King mackerel tagged off Tamaulipas and Veracruz were mostly recovered in May (63) and June (37). In spring, especially May, 80 of 81 tags recovered from this tagging were recovered off Veracruz in the commercial fishery. In summer, 51 of 60 tags were recovered off Veracruz while the other 9 tags were taken off Texas (5), Tamaulipas (2), Louisiana (1), and Campeche (1). Seven tags were returned in the fall, from Veracruz (5), Yucatan (1) and Texas (1), while 10 tags (Campeche (4), Veracruz (3), and Yucatan (3)) were recovered during the winter at the southern extent of the range of these fish.

### **Yucatan Peninsula**

The handline fishery is not found off the Yucatan Peninsula. In this area, gillnets were the fishing gear primarily used for king mackerel. The fish that were tagged here were tagged by INP and Mote Marine Lab biologists from research vessels.

Off the Yucatan Peninsula, including the states of Quintana Roo, Yucatan, and Campeche, 164 king mackerel were tagged. All fish were tagged in the months of January through April and 4 tags were recovered.

Of the three king mackerel recovered from tagging off Yucatan, only one was recovered outside of that state. This tag was recovered in summer off Veracruz. The one tag recovered from tagging off Campeche was recovered in Yucatan over two years later.

In summary, the MEXUS-Gulf king mackerel tagging over these seven years added greatly to our knowledge of king mackerel movements in the Gulf. Although we had indications of international movements of king mackerel, this tagging showed that these movements are commonplace and when this information is combined with genetic data based on electrophoretic studies, it is apparent that at least two stocks are present in the Gulf of Mexico, with the western stock making annual migrations into U.S. waters, and being exploited by both nations.

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